PETRO-PALYNOLOGICAL STUDIES OF COAL IN ASHOKA (OCP), PIPARWAR AREA OF NORTH KARANPURA COALFIELD, DISTRICT-CHATRA, JHARKHAND

A Synopsis submitted to the University Department of Geology,

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The topic of the research: PETRO-PALYNOLOGICAL STUDIES OF COAL IN ASHOKA (OCP), PIPARWAR AREA OF NORTH KARANPURA COALFIELD, DISTRICT-CHATRA, JHARKHAND

1. STATE-OF-THE-ART:

India is the world's fastest-growing major economy and is expected to become the world's third largest economy in the coming years. With the rapid industrial growth, the need for energy has grown during the past ten years and will soon continue to do so. India's need for energy is growing annually, and the nation must rely primarily on coal to meet this demand. Currently, coal supplies around 60% of the world's commercial energy needs. Because coal is so abundant compared to the extremely limited resources of oil and natural gas, it is very significant to India's energy landscape. It will remain dominant as the main source of commercial energy until there is a greater reliance on renewable energy sources.

To meet the energy requirements of our nation, the Government has undertaken several initiatives to scale up domestic coal production. Therefore, as against the increased coal demand, domestic coal production has also increased. In 2022-23, the domestic coal production increased by 14.77% to reach 893.19 MT from 778.21 MT in 2021-22.

The Lower Gondwana coals are mostly found in three significant depositional basins in India. The Godavari Valley basins, the Son-Mahanadi Valley basins, and the Damodar-Koel Valley basins. The Damodar River basin spans the districts of Hararibagh, Ramgarh, Koderma, Giridih, Dhanbad, Bokaro, and Chatra in Jharkhand, with a catchment area of 25820 km. In comparison to the coal of the northern hemisphere, which belongs to the Carboniferous Period and formed from coalification processes. Gondwana coal occurs in different coal bearing sequences of the Permian Period and is derived from drifted plant material deposited in basins or valleys i.e. the coal is allochthonous in nature (Krishnan, 1982, Navale, 1974, Navale, 1976, Navale, 1978). Karanpura coalfield, one of the major coal-bearing Gondwana basins in peninsular India extends for about 38 km in a north-south direction and 75 km in an east-west direction encompassing an area of about 2280 sq. km. North Karanpura has a total area of 1,224 sq. km. The Piparwar project was the first coal mine in the North Karanpura Coalfield. The total area allocated under coal blocks is 600.15 ha in NKCF (Central Mine Planning & Design Institute 2016).

1.1 LOCATION OF THE STUDY AREA:

The study area is the Ashoka coal mine, Piparwar area, Block-Tandwa, District-Chatra, North Karanpura coalfield. It is operated under CCL. The Ashoka is located between latitude 23°42'53" - 23°44'41" N and longitude 85°57'7" - 85°4'11" E. The Ashoka block comprises an area of around 12.27sq km located in the north of the Damodar valley in the south-central part of the North Karanpura coalfield. It is connected to Ranchi by a metaled road via Khalari and to Hazaribagh via Barkagaon. The distance of the Project from Ranchi is about 80 Kms. The nearest Railway Station is 'Ray', on the Gomoh- Dehri on the Sone loop line of the Eastern Railway, which is located about 10km away from the study area. The Ashoka block is covered by Geological Survey of India Toposheet No. 73 E/2 & 45B2.

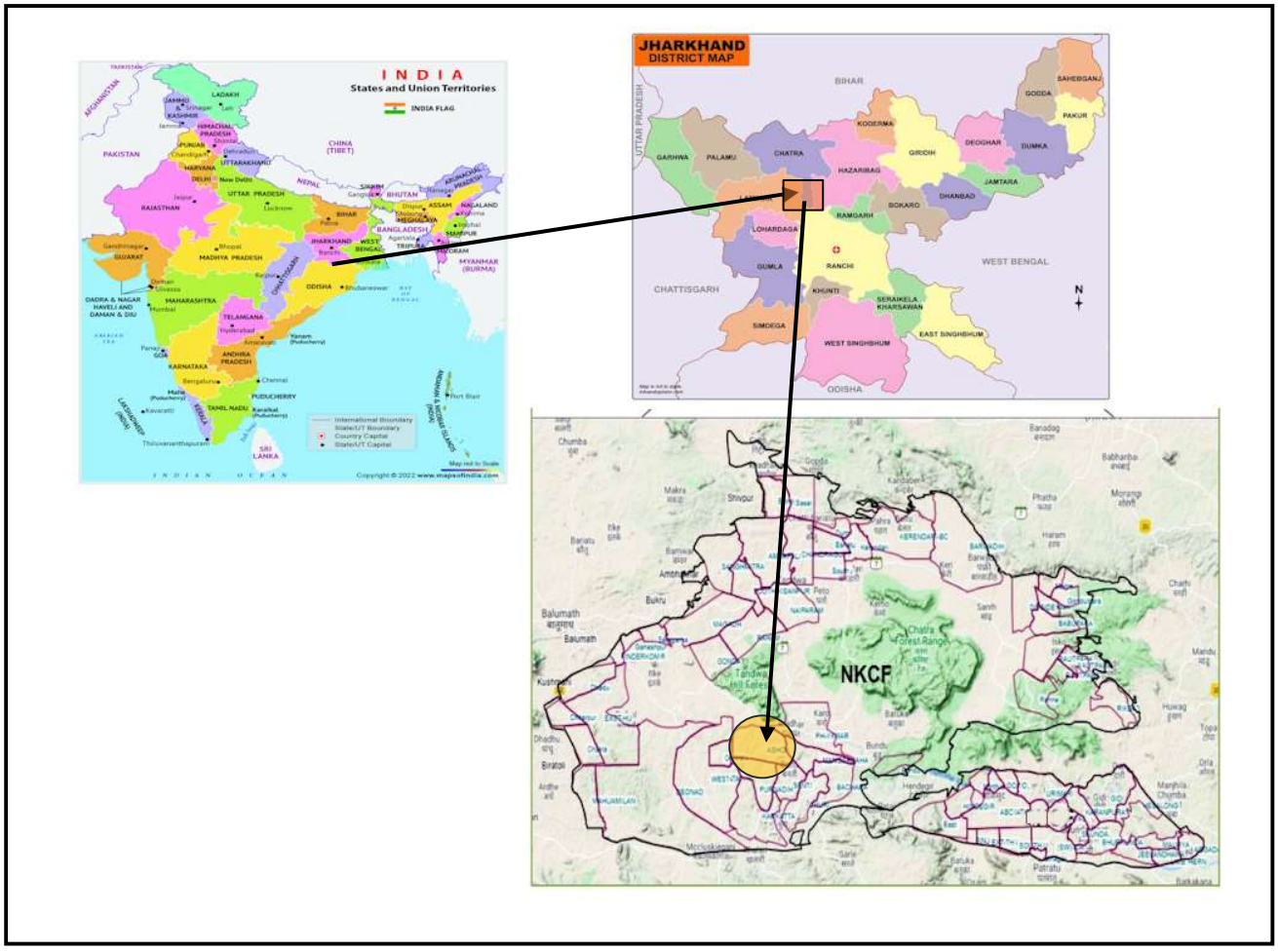

Figure 1. Location map of the study area (Ashoka block, piparwar area, North Karanpura Coalfield) in India map.

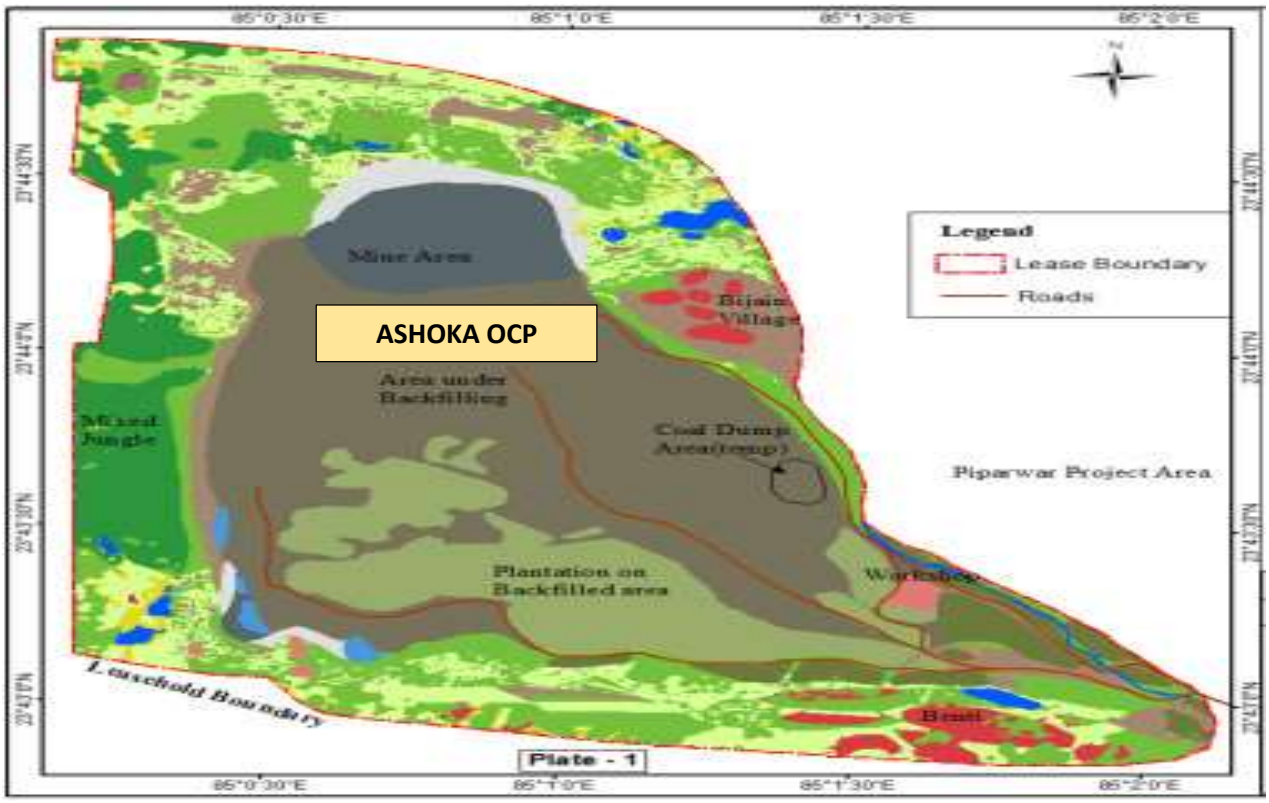

Figure 2. Ashoka OCP mine

Source -Ashok EC Compliance March 2020 – Central Coalfields

1.2 Physiographic feature

The Ashoka block is characterised by more or less flat terrain with gentle undulations. The general slope of the ground is towards the south. The outcrops of coal seam are generally characterised by low lying areas and paddy fields. The ground elevation above mean sea level varies between 420m and 480m. A prominent physiographic feature 'Satohari Hill' (height 636m) lies in the north of the block.

1.3 Climate and Drainage

The climatic conditions prevailing in the Ashoka mine have temperatures of 24°C to 42°C. The average annual rainfall is 152 cm. The main drainage pattern of the block is controlled by several tributaries of the Damodar river flowing from north to south. The Two important nallas, namely Dambua & Benti, originate from the area and join the Damodar River, which forms the main drainage channels of the area.

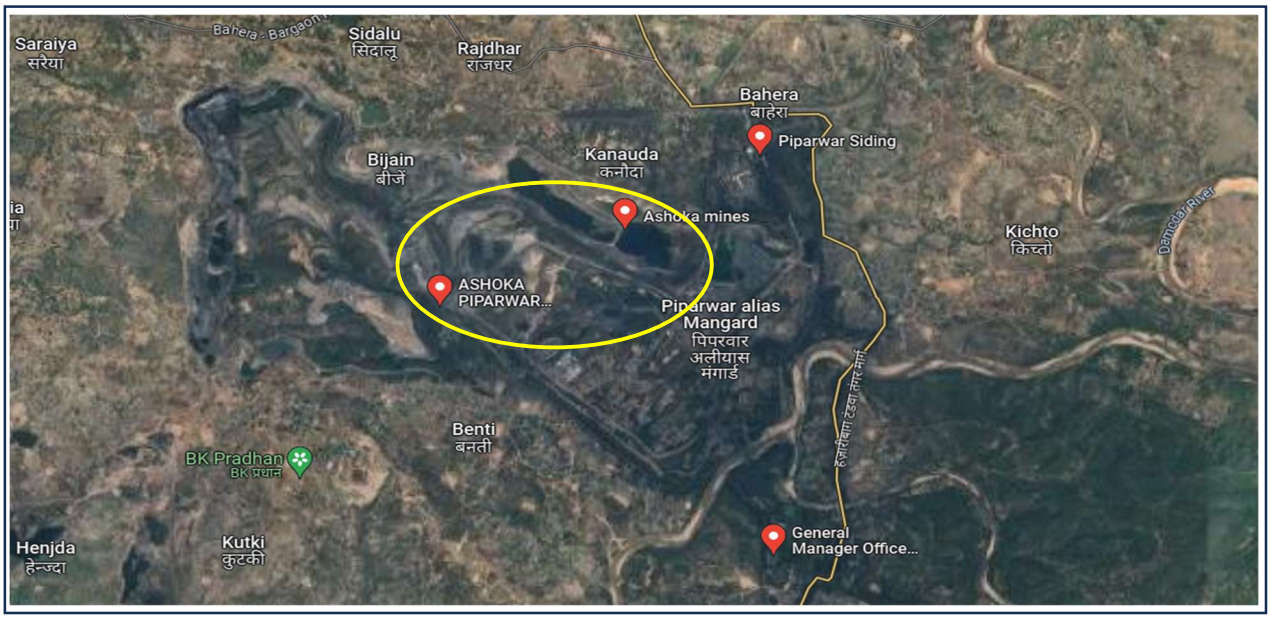

Figure 3. Satellite image of study area (Ashoka OCP) Source – Google map

1.4 GEOLOGY & STRATIGRAPHIC SEQUENCE:

The North Karanpura Coalfield forms a part of the east-west trending valley between the Hazaribagh plateau in the north and the Ranchi plateau in the south. A lengthy, east-west metamorphic stretch called the Aswa Pahar divides the South Karanpura Coalfield from the North Karanpura Coalfield. They are inter-connected near Bachra and Hindgir by a narrow tongue of

Talchir outcrops. The area comprises mainly of Barakar, Karharbari and Talchir formations. However, the rocks of only the Barakar formation are exposed in this block. The predominant rock types of Barakar formations are sandstone and grey wackes followed by occasional shale intercalation of shale and sandstone, fire clays etc.

Table 1. Genralized stratigraphic sequence of North Karanpura coalfield.

PERIODS	GROUPS	SUB-GROUP	FORMATION	LITHOLOGY
Recent	-	-	Alluvium	Detrital & alluvial soil & sub-soil
Jurassic	-	Co-ovals of Rajmahal Traps	Igneous Intrusive	Dolerite & mica peridotite
Triassic	Upper Gondwana	-	Mahadeva	Massive coarse to conglomeratic Feldspathic ferruginous sandstone with shale intercalations.
Upper Permian to Lower Triassic	Lower Gondwana	-	Panchet	Yellowish to white coarse grained sandstone, red coloured plastic clays. In upper part yellowish friable sandstone whereas greenish yellow sandy shale in the lower part with sand dune structure.
Upper Permian	-	-	Raniganj	Fine to medium grained quartzo Feldspathic & quartzitic sandstone often micaceous & matured

				interbanded with shale carbonaceous shale fire clay and coal seams.
Lower Permian		Damuda	Barren measures	Dark shale, sandy micaceous shale with siderite interbanded shale & sandstones.
			Barakar	Conglomerates, shale, greywackes, sandstone interbanded with shale, carbonaceous shale fire clay And coal seams.
			Karharbari	Grey-wackes, Dark mottled sandstone with occasional shale bands, fire clay, chocolate clays & coal seams
Permo - Carboniferous	-	-	Talchir	Rikba plant beds, boulder conglomerates varvites, sandstone , tilloids & tillites
Precambrian	-	-	metamorphics	Granite gneiss, pegmatites, phyllites mica-schist & limestones, chromites bearing rock amphibolites and quartzites

2. PROBLEM TO BE INVESTIGATED:

- To determine the rank of the coal.
- To analyse the detailed petrographic characteristics of coal.
- To study the microscopic spores and pollen preserved in coal.
- To determine the age of the fossil samples.
- To depict the depositional palaeoenvironment.

3. OBJECTIVE OF THE INVESTIGATION AND MOTIVATION:

- Determination of the rank of the coal.
- Determination of different properties of coal samples in the laboratory by Proximate and Ultimate analyses.
- To study the lithotype and maceral present in the rock.
- To date and correlate various coal seams formation through the detailed study of palynomorphs.
- To analyse the paleoclimatic condition from the study of spores and pollens present in the coal.

4. HYPOTHESIS:

The petrographic examination of coal is an invaluable tool for the coal industry. It facilitates the appraisal of resources and coal exploration. Classification and commercialisation of coal. It facilitate to completion of the data analysis by examining the microscopic world of pollen and spores preserved in coal. It helps scientists learn important details about the climate, ecology, and geological settings surrounding coal deposition in the past. For the purposes of coal exploration, resource assessment, and comprehending the effects of coal use on the environment, these information is essential.

5. RESEARCH DESIGN & METHODOLOGY:

The Methodology and Research design of the study area will include :

Step 1 :

- Field survey
- Photography
- Cataloguing
- Literature survey
- Make arrangements for the collection of samples.

Step 2: Research analysis will be carried out in the following stages-

- Petrograghical study
- Collection and storage of fossils
- Microscopic study of fossils
- Palynological study
- Interpretation of data

Petrographic study of coal:

The study will be done in the following stages –

Stage 1: Reduction of the quantity of coal sample (coning and quartering)
Stage 2: Grinding
Stage 3: Sieving

Chemical analysis of coal:

Moisture, volatile matter, ash content and fixed carbon in coal will be determined by proximate analysis. The elemental constituents of the organic part of coal are carbon, nitrogen,

hydrogen, sulphur, and oxygen and estimation of relative proportion is done through the ultimate analysis of coal.

Palynological study of coal:

- The samples will be collected from different areas of Ashoka mine, North Karanpura coalfield and will be appropriately catalogued, numbered and stored in the repository namely viz, Coal Laboratory, University Department of Geology, Ranchi University, Ranchi.

- All the collected samples will be prepared by different appropriate maceration techniques.

  Microspores will be recovered from the sediments by usual maceration techniques. About 5-7 g of the material from each sample was first treated with conc. Hydrofluoric acid for 2 days and then with commercial nitric acid for 3-4 days followed by treatment with 10% potassium hydroxide after thorough washing with water. The macerates will then be mounted in Canada Balsam and the slide will be prepared, followed by photography (Bharadwaj & Salujha 1964), (Jha et al., 2007).

6. TOOLS TO BE USED IN THE COLLECTION OF DATA

• Toposheet	• Chisels
• Handheld GPS	• Haversack or Plastic bags
• Clinometer compass	• Field notebook
• Hand Augur	• Brushes
• Palynological microscope	• Hand lens

7. SIGNIFICANCE OF THE STUDY:

- The detailed microscopic study of a group of macerals will help to determine the coal type and rank of coal.
- Classification of megafossils for determining age.
- Correlation and comparative study of coal seams.
- Study of distribution of macerals and mineral matter allow to optimize coal processing methods like beneficiation to yield better quality coal products.

8. IT'S RELEVANCE TO THE PRESENT-DAY PROBLEM AND NEED TO SOCIETY:

In some developing countries, coal remains a vital resource for achieving electrification and economic growth, especially where alternative energy infrastructure is lacking. Studies on petrographical characteristics of coal will enlighten the significance of quality of coal found in the Ashoka (OCP) mine. It will provide valuable information for efficient and sustainable coal utilization. The petro-paleontological analysis will help in the comparative study of coal seams, infer a correlation and decipher the paleoenvironment condition. Palynomorphs will help understand the evolution of life, determining the age of various lower Gondwana sequences found in the Ashoka mine. It will give vivid information on paleoclimate.

9. CONTRIBUTION TO THE EXISTING KNOWLEDGE:

The comprehensive study of petrographic and chemical properties of the coal seam of Ashoka (OCP), piparwar area will assist in determining the coal quality, rank and potential for different uses. The study of fossils in the study area will contribute to the existing knowledge in a better understanding of paleoenvironment conditions. These studies will have a great impact on the effective utilization of coal.

10. FUTURE WORK:

On the basis of petrographic properties, the coal can be further categorised on the basis of type, rank and grade. Using these petrological data and organic geochemical data further work can be done to determine the hydrocarbon generation of coals. Based on these studies it will help to determine its use in different processes, like carbonization and liquefaction of coal in the study area. Research work on fossils will provide opportunities not only in the field of geology but also in the botany field of research. Further study on lithofacies and correlation coal seams will help to explain the disposition of the lateral and vertical facies.

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